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Relation between relief and crustal structure in the Cantabrian Mountains (Spain) using DEM-GIS analysis

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The Cantabrian Mountains show a linear E-W trend parallel to the northern coast of Iberia peninsula, from the Pyrenees to Galicia, where it looses its trend and linearity. The western end of the linear segment of the orogen coincides with a change in the style of structures, accommodating the N-S shortening during the convergence between Europe and Iberia plates.
We study the relief of the 230 km-long segment of the linear range between the Cantabria and Galicia re- gions, up to 2,650 m altitude. The bulk trend of the orogeny is controlled by the orientation of alpine thrusts that accommodate the shortening in relation to plate convergence. The Alpine Orogeny produced crustal thickening and the present day topography. Crustal thickness varies from 30 km in Eastern Cantabrian Mountains to 45-55 km at the Middle part of these mountains. The collision between European and African plates localized in northern Iberia from the Eocene to Oligocene and later migrated to southern Iberia during the Miocene. No major tectonic convergence was accommodated in the Cantabrians Mountains since the Oligocene, entering the orogen an erosional phase since then.
The GIS-analysis present here, using 5 and 25 m-resolution DEMs by the Spanish National Geographical Institute, aims to identify the major features and to characterize the overall relief of the Cantabrians Mountains. In our preliminary approach, we present swath profiles, major river basins, watershed, longitudinal profiles of major rivers and hypsometric curves from selected areas that cover the studied orogen segment. Major tectonic structures control the location and orientation of the main watershed of the mountain range, but also the orientation of some local watersheds, e.g. associated to the Llanera thrust or the Ventaniella (strike-slip) fault. An unexpected result is that the average altitude along the water divide is 1,500 m, regardless of the large differences in crustal thickness along the study area. Most longitudinal river profiles running south to north lack knick points in relation to relief forming tectonic structures, indicative of the predominance of fluvial erosional system postdating tectonics. An emerged coastal wave-cut platform dipping gently towards the West, a slight increase in maximum mountain altitude to the east and slight increase in river incision also towards the East may indicate that a gradient in erosion and in up-lifting exists increasing from West to East. This is consistent with an overall increase of crustal thickness along this direction.